Chapter 6
Flood Modelling and Mapping: Case Study on Adyar River Basin, Chennai, India

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ABSTRACT

This chapter presents an overview of the important concepts related to flood hazard assessments and explores the use of remote sensing data from satellites to supplement traditional assessment techniques. The method presented in this chapter can be used in sectoral planning activities and integrated planning studies and for damage assessment. The chapter presents the application of flood modelling to the study area. The study area, Adyar River in Chennai, has experienced major floods in the past decade which is attributed to increased urbanization. The hydrologic model for the Adyar River Basin was set up using HEC geoHMS and was run and calibrated using observed flow in HEC-HMS. The chapter also discusses the results obtained from the IDF analysis and its application in HEC HMS to generate hypothetical storm hydrographs. Furthermore, the chapter goes on to discuss the results obtained from the hydraulic modelling such as the inundation map for the 2005 flood event and the inundation map for hypothetical storms of varying return periods.

DOI: 10.4018/978-1-5225-9771-1.ch006

INTRODUCTION

Flooding is a natural process, which occurs over a river, stream and plains in a recurring manner depending on various factors such as landuse, rainfall, soil etc. As per studies, the mean annual flood occurs every 2.33 years (Leopold et al., 1964). Flooding is due to a heavy or continuous rainfall exceeding the infiltration capacity of soil and the carrying capacity of rivers, streams, and coastal areas. This causes a river or stream to overflow over its banks onto adjacent lands. The frequency of flooding has increased over the past few decades causing havoc to life and property. Though it is impossible to predict when a flood event is going to occur, it is possible to predict the damage which would be caused by a flood, if it ever occurs. This can be done by generating inundation maps for different return periods and performing flood risk modelling. The damage caused by a flood varies from place to place as a variety of factors contribute towards flood risk. The land use and soil type play an important role in estimating how much of the rainfall is converted into runoff. In cities, the rapid urbanization plays an important role in contributing to increased runoff resulting from increased percentage of impervious area. The slope of the flood plain is also an important factor. If the flood plain has very low slope, it takes a longer time for the runoff to flow out and remains stagnant for a longer period. Flood modelling is carried out using spatial data such as satellite imagery, digital elevation model and soil map. In addition to spatial data, historical rainfall data and discharge data is required to generate the IDF curves and to calibrate the hydrologic model.

Accurate modelling of surface has to be done in order to estimate the spatial and temporal distribution of parameters. With the advent of remote sensing and Geographical Information System, it has become easier to manage a large set of spatial and temporal data pertaining to hydrological models.

This chapter deals with detailed procedure of probabilistic assessment of flood using remote sensing data and softwares in addition to the conventional techniques.

The primary objective of application of remote sensing tools is to map flood prone areas with accuracy within a short period. This assessment method will lead to flood prediction which will help the planners to assess the probable impact of disaster due to flood. . The method presented in this chapter can be utilised in regional planning activities and damage assessment due to floods.This section is designed to provide the planner with background information on the nature of floods and the terms and concepts associated with assessing the risks from this natural hazard. The various flood characteristics are shown in Fig.1.